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ABSTRACT

Summarized are results of the National Science Foundation's Survey of Scientific and Engineering Expenditures at Universities and Colleges for the fiscal year 1979. The principal finding is that research and development expenditures at universities and colleges totaled $5.2 billion in fiscal year 1979, up 12% in current dollars and 3% in constant 1972 dollars over 1978 levels. Also discussed are data and trends related to funding sources, character of research work, field of science, and the institutional breakdown of expenditures. (Author/WB)

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SCIENCE RESOURCES STUDIES HIGHLIGHTS

NATIONAL SCIENCE FOUNDATION WASHINGTON, D.C. 20550 APRIL 28, 1981 NSF 81-304

ED204123

R&D Expenditures Increased 3% in Real Terms at Universities and Colleges in FY 1979[1]

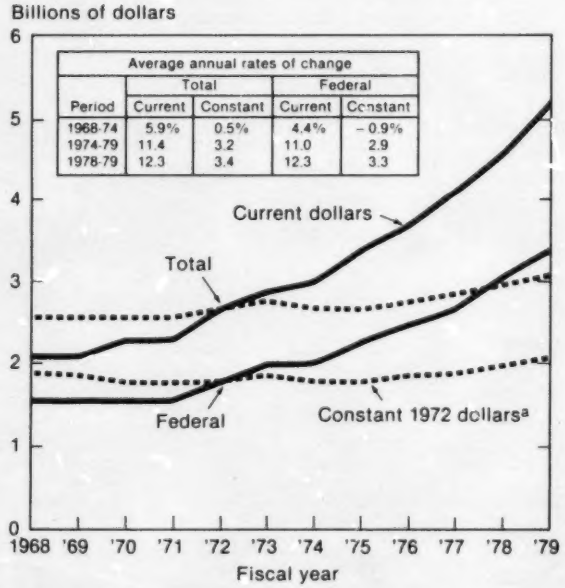
This report contains the findings of the National Science Foundation's (NSF) Survey of Scientific and Engineering Expenditures at Universities and Colleges, FY 1979. The survey was mailed to 567 universities and colleges including all institutions that grant a graduate degree in the sciences or engineering, as well as to academic institutions with $50,000 or more in separately budgeted R&D expenditures. Estimates made by NSF for nonrespondent institutions represent less than 4 percent of total academic R&D spending. Data presented are in terms of current dollars except where specified as constant 1972 dollars. The latter are based on the gross national product (GNP) implicit price deflator.

Highlights

- Separately budgeted R&D expenditures at universities and colleges totaled $5.2 billion in fiscal year 1979, up 12 percent in current dollars and 3 percent in constant 1972 dollars over 1978 levels (chart 1). Following a 6-year period of little or no growth, real-dollar academic R&D spending increased 3 percent per year between 1974 and 1979. During the latter period, real R&D spending growth occurred at rates of 2 percent per year in the industrial sector and 1 percent annually in Federal laboratories.

- Federally financed R&D expenditures in academe also increased 3 percent in real terms in 1979. The academic sector conducts one-half of the U.S. basic research effort, and between 1974 and 1979, Federal support for university performance of basic research increased at an average rate of 2 percent annually in constant dollars. Double-digit inflation in 1980, however, may interrupt this growth cycle.

Chart 1. Total and federally financed R&D expenditures at universities and colleges



[a]Based on GNP implicit price deflator.
SOURCE: National Science Foundation

[1]All years are fiscal unless otherwise specified.

(Prepared in the Universities and Nonprofit Institutions Studies Group, Division of Science Resources Studies)

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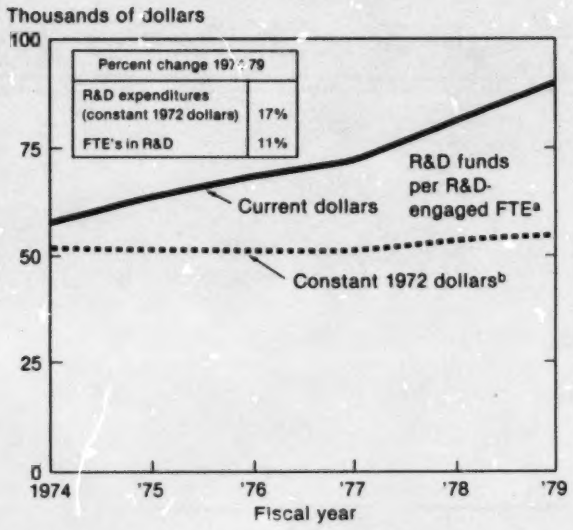
• Since constant-dollar R&D spending grew faster between 1974 and 1979 (17 percent) that full-time equivalent (FTE) involvement of academic scientists and engineers in R&D activities (11 percent), the constant-dollars available per FTE researcher actually increased 5 percent during this period (chart 2).

• Academic R&D expenditures increased in all major S/E fields between 1978 and 1979, with the largest relative gain reported in engineering, up 19 percent. For the life sciences, which accounted for more than one-half of academic R&D expenditures, an 11-percent rise was reported between 1978 and 1979.

Chart 2. R&D expenditures at universities and colleges per FTE scientist/engineer engaged in R&D activities



[a]Based on data collected for full-time-equivalent scientists and engineers in the Survey of Scientific and Engineering Personnel Employed at Universities and Colleges.
[b]Based on GNP implicit price deflator.
SOURCE: National Science Foundation

Source of Funds

Federally financed R&D expenditures by academic institutions, which showed a drop of 1 percent per year in constant dollars in the period 1968-74, increased at an average of 3 percent per year in the subsequent five years. Four agencies accounted for most of the growth in Federal support of academic R&D programs during the seventies: The National Institutes of Health (NIH), the Department of Defense (DOD), NSF, and the Department of Energy (DOE). NIH alone provided nearly two-fifths of the 1974-79 Federal funding increment.[2]

The Federal budgets for 1980 and 1981 indicated that the 5-year trend of real-dollar increases for academic R&D support has been interrupted. Federal R&D obligations, which have been indicators of future trends in total R&D expenditures by research universities, show a 1-percent drop in real terms in both years.

Non-Federal sources provided one-third of academic R&D support in 1979 and included State and local government appropriations, industry and foundation grants or contracts, as well as universities' own contributions to organized research activities. In the period 1974-79, R&D funding by non-Federal sources expanded at an even higher rate than Federal R&D funding, for an average growth rate of 4 percent per year in constant dollars. Industry R&D support led all other non-Federal sources with an average gain of 7 percent per year. The extent of total corporate support of higher edcuation R&D activities may be understated in these survey results. R&D support from industry often is reported as "institutional funds," because it can take the form of unrestricted operating grants that university administrators designate for research performance. Several university officials have cited these discretionary funds as being responsible for much of the 6-percent per year constant-dollar growth in R&D support from the institutions themselves in the 1974-79 period. In addition, a 1980 study on university/industry-research cooperation indicates that "... a trend toward (industry) involvement with university based institutes seems to be growing in all fields."[3]

Character of Work

Universities and colleges expended $3.6 billion for basic research in 1979. When measured in constant dollars, fundamental research by universities increased 5 percent per year in the period 1977-79, following a 3-percent increase from 1976 to 1977 when the impact of the Ford Administration's commitment to real growth in Federal support of fundamental research in all sectors first became evident in academic R&D expenditure levels. The Federal Government provides 71 percent of all basic-research support to universities and colleges where about one-half of such research is performed (chart 3). In 1979, for example, 44 percent of the Federal academic basic research budget was provided to universities and colleges solely by NIH.[4]

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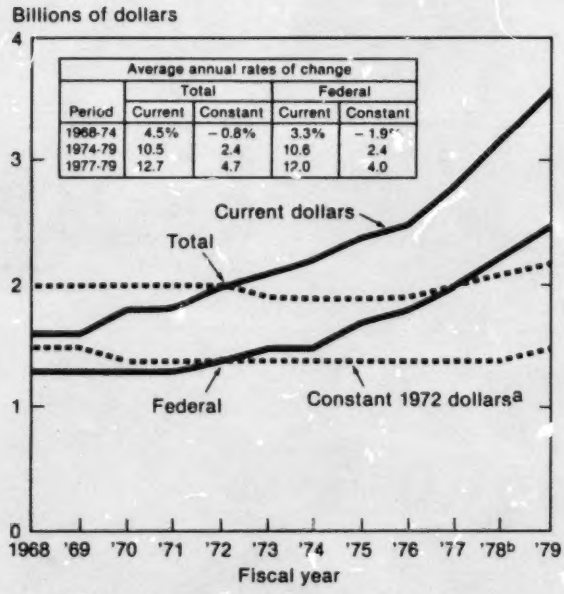
[2]National Science Foundation, *Federal Funds for Research and Development, Detailed Historical Tables, Fiscal Years 1970-81*, November 1980 (unpublished).
[3]Neal H. Brodsky, et. al., *University/Industry Cooperation: A Preliminary Analysis of Existing Mechanisms and Their Relationship to the Innovation Process* (New York: New York University Press, 1980).
[4]National Science Foundation, *Federal Funds for Research and Development, op. cit.*

Academic expenditures for applied research and development together rose 29 percent in current dollars between 1977 and 1979, or 11 percent in constant dollars. Similarly, basic research performed by universities went up 27 percent overall, or 10 percent in real terms, in the same period. Generally, the development share of the academic R&D total amounts to 4 percent; when added to the share devoted to applied research, together they constitute almost one-third of the total research and development performed by universities in 1979.

Field of Science

Between 1978 and 1979, the rate of growth of R&D expenditures exceeded the 9-percent U.S. inflation rate in seven of the eight major S/E categories. The largest relative increase occurred in engineering — up 19 percent. In the period 1974-79, when growth in total academic R&D expenditures exceeded the average 8-percent inflation rate by 3 percentage points per year, R&D funding in six major fields also increased at rates greater than the national inflation rate (chart 4). The adequacy of research funding, however, cannot be determined from these statistics alone. In addition to funding, the quality or availability of graduate research assistants, technicians or scientific apparatus plays a significant role in the conduct of research. The importance of these factors varies considerably among disciplines. For example, a recent NSF-funded study suggested that departments in equipment-intensive areas in physics, chemistry, and electrical engineering have lacked the financial resources to purchase and maintain scientific apparatus necessary for frontier research.[3] The continued growth in current-dollar R&D spending in these areas during the seventies has been surpassed by the rising costs of scientific instrumentation.

Chart 3. Total and federally financed expenditures for basic research at universities and colleges

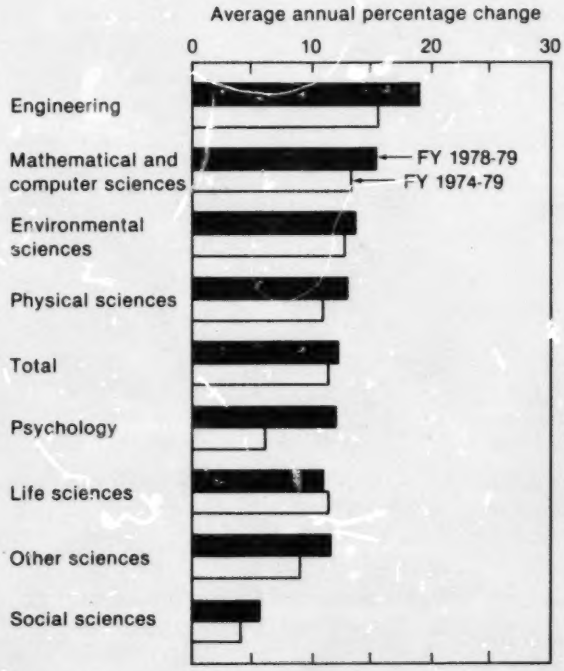

Billions of dollars
4
3
2
1
0
Average annual rates of change
Period | Total Current | Total Constant | Federal Current | Federal Constant
1968-74 | 4.5% | – 0.8% | 3.3% | – 1.9%
1974-79 | 10.5 | 2.4 | 10.6 | 2.4
1977-79 | 12.7 | 4.7 | 12.0 | 4.0
Current dollars
Total
Federal
Constant 1972 dollars[a]
1968 '69 '70 '71 '72 '73 '74 '75 '76 '77 '78[b] '79
Fiscal year

[a]Based on GNP implicit price deflator.

[b]Estimated.

SOURCE: National Science Foundation

Chart 4. R&D expenditures at universities and colleges by field



SOURCE: National Science Foundation

The primary sponsor of academic R&D activities in each S/E field is the Federal Government, whose share of total R&D funding ranges from 80 percent in the physical sciences to 53 percent in the social sciences. In the period 1974-79, federally financed R&D funds increased most rapidly in engineering with an average rate of growth of 15 percent annually.

[3]Laurence Berkowitz and Richard A. Zdanis. *The Scientific Instrumentation Needs of Research Universities* (Washington, D.C.: Association of American Universities, 1980), p. 19.

Institutional Distribution

In 1979 R&D expenditures were highly concentrated in a relatively few institutions; the 100 leading research universities accounted for 83 percent of the total. This level of concentration has not changed appreciably during the 1974-79 period of constant-dollar R&D growth.

Massachusetts Institute of Technology continued for the second year as the leading academic R&D performer ($142 million) and also the leading recipient of Federal R&D funds ($121 million) (table 1). Of the top 100 research universities, 94 reported R&D increases in 1979.

Table 1. Twenty institutions reporting the largest R&D expenditures in the sciences and engineering: FY 1979

[Dollars in thousands]

Institution	Total		Federal	
	FY 1979	Percent change, FY 1978-79	FY 1979	Percent change, FY 1978-79
Total, all institutions	$5,182,729	12	$3,431,538	12
Total, leading 20 institutions	1,764,277	12	1,259,773	13
1. MIT	141,596	18	120,971	18
2. Univ. of Wisconsin-Madison	122,239	13	78,096	13
3. Univ. of Calif.-San Diego	107,750	13	96,375	15
4. Univ. of Michigan	107,035	23	67,396	15
5. Univ. of Minnesota	106,077	12	61,150	15
6. Stanford Univ.	101,681	15	91,511	16
7. Cornel Univ.	100,295	20	67,001	22
8. Univ. of Washington	98,967	11	83,276	11
9. Harvard Univ.	89,008	6	67,374	6
10. Columbia Univ.	82,831	11	67,012	12
11. Univ. of Pennsylvania	81,961	7	58,941	12
12. Univ. of Illinois-Urbana	75,972	3	44,870	6
13. Johns Hopkins Univ.	75,592	18	64,723	20
14. Univ. of Calif.-Los Angeles	75,496	4	60,102	4
15. Univ. of Calif.-Berkeley	75,344	7	53,520	9
16. Univ. of Texas-Austin	69,894	17	45,861	17
17. Pennsylvania State Univ	64,054	– 1	40,859	– 4
18. Texas A&M Univ.	63,271	6	28,127	12
19. Ohio State Univ.	62,747	23	35,181	31
20. Michigan State Univ.	62,666	13	27,827	13
Total, all other institutions	$3,418,452	12	$2,171,765	12

[1]Estimate
SOURCE: National Science Foundation

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Academic Science: R&D Funds, Fiscal Year 1979 (Detailed Statistical Tables) (NSF 81-301) can be obtained from the Division of Science Resources Studies, National Science Foundation, Washington, D.C. 20550. For information on the availability of data tapes, call Moshman Associates, Inc., at 301-229-3000.

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